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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/561,937	06/20/2006	Pavel Bokov	GRY-142US	2961

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EXAMINER	
DUDNIKOV, VADIM	

ART UNIT	PAPER NUMBER
3663	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/561,937	BOKOV ET AL.	
	Examiner	Art Unit	
	Vadim Dudnikov	3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 22 December 2005.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 13-23 is/are pending in the application.

4a) Of the above claim(s) 18 and 22 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 13-17,19-21 and 23 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 22 December 2005 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 11/02/07;5/1/06.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of election in the reply filed on 09/27/07 is acknowledged. The traversal from election between subspecies (A) and (B) is not found persuasive because the limitations of claim 19 are disclosed in combination of prior art (see claims rejection).

Applicant indicated that claims 13-17, 19-21 and 23 read on the elected species. Said election of the claims related to election of the subspecies (B). Claims 18 and 22 are withdrawn from consideration as non-elected. The Restriction and Election-of-Species Requirement is herewith made FINAL.

Rejections of claims are established in light of consideration and search of the prior Art.

Specification Objection

2. Specification is objected to because formulas in sections [0062], [0066] are incorrect because expression $r_0=(1=k_{eff})/ k_{eff}$ is incorrect because it presents incorrect reactor parameters.

The applicant is requested to perform a thorough review of the specification to facilitate an appropriate correction to this objection. The corrected specification is required in

reply to the Office action to avoid abandonment of the application. The requirement for corrected specification will not be held in abeyance.

Specification is objected to under 37 CFR 1.75 (d) for not disclosing clearly what is Applicant's invention is.

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. The specification is objected to under 35 U.S.C. 112, first paragraph, as failing to provide an adequate written description of the invention and as failing to adequately teach how to make and/or use the invention, i.e. failing to provide an enabling disclosure.

In the disclosed method of accelerator coupled hybrid nuclear system control relations are presented between the accelerator and nuclear system parameters. Said relations are presented as formulas. Said formulas are valid or can be used in a relative narrow area of parameters variations because relative high power is needed for accelerator operation support without particle beam generation and relations between many parameters are nonlinear but approximated by linear dependences. There are no a proper determination of the areas of allowable parameters variation.

Particularly, parameter f^{nom} (used in independent claims 1 and 19) cannot be constant or finite for some modes of system operation because a relative high power is needed for accelerator operation support without particle beam generation. By this reason parameter f^{nom} cannot be "predetermined".

Parameter "level of subcriticality (r_0)" recited in claims 15 and 16 is determined incorrectly in specification, section [0066], as detailed above. Value of "the negative fluctuations of the power of the reactor in the normal operating mode of the reactor" recited in claims 14 and 20 is not determined in application.

It is in need to present explanation of expression: "much greater than possible negative fluctuations of the charged particle energy in response to the negative fluctuations of the power of the reactor in the normal operating mode of the reactor" recited in independent claim 20.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 13-17, 19-21 and 23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Said claims are indefinite

because formulas used for claims limitation discloses are valid or can be used in a relative narrow area of parameters variations and these areas of allowable parameters variation are not determined in application. Particularly, parameter f^{nom} (used in independent claims 1 and 19) cannot be constant or finite for some modes of system operation because a relative high power is needed for accelerator operation support without particle beam generation. By this reason parameter f^{nom} cannot be "predetermined".

Parameter "level of subcriticality (r_0)" recited in claims 15 and 16 is determined incorrectly in specification, section [0066], as detailed above in section 2. Value of "the negative fluctuations of the power of the reactor in the normal operating mode of the reactor" recited in claims 14 and 20 is not determined in application.

It is in need to present explanation of expression: "much greater than possible negative fluctuations of the charged particle energy in response to the negative fluctuations of the power of the reactor in the normal operating mode of the reactor" recited in independent claim 20. Specifically, what is "much greater" is not rendered definite by the Specification and is, in normal parlance, a matter of subjective judgment; while "much" is a vague term of relative degree because the nature of the implied relation of likeness is not disclosed, certainly not definitely quantified. For all of the above reasons the limitation as quoted above as it occurs in the claims 13 and 23 is indefinite.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 13-17, 19-21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadi et al., (Design of accelerator-driven system for the destruction of nuclear waste", LNS0212002, lecture given at 3 September 2001) in view of Knief ("Nuclear Engineering), Hemisphere Publishing Corporation, 1992).

As can be best understood in the presence of the indefiniteness under 35 U.S.C. 112, second paragraph, detailed above, regarding the claim **13**, Kadi et al., (assuming that the "level of subcriticality" is as disclosed by Kadi et al. on page 100, lines 6+) disclose:

a method of controlling an accelerator coupled nuclear system (ACS) (page 91, lines 26+, Fig. 3) comprising a nuclear reactor having a core (Fig. 3, Fig. 16page 110, lines 1+), the nuclear reactor, operating in sub-critical mode (page 87, lines 8+), and a neutron generator device using a beam of accelerated charged particles (Fig. 3, page 92,lines 1+), the neutron generator consuming a predetermined amount of energy from produced by the core in order to produce a number of external neutrons for maintaining a nuclear chain reaction in the core ("f" in Fig. 3, page 92, lines 1+), and an operating point of the system being selected at a nominal charged particle energy E_p^{nom} close to an optimal energy value E_p^{max} for which a relationship between the number of external neutrons produced and an energy of a beam of the charged particles used by the neutron generator device to produce the neutrons is maximum (Fig. 15, pages 108-109,), the method comprising the steps of, for a self-regulated and reliable operation of the coupled system selecting the nominal particle energy E_p^{nom} to be greater than the optimal energy value E_p^{max} (operation points with proton kinetic energy above 1 GeV in Fig. 15), and adjusting the number of external neutrons by acting on the energy of the charged particles (E_p) generated and accelerated by the accelerator (as shown in Fig. 15; operation of sub-critical reactor with accelerator driving external neutron source with different energies of particle accelerator).

Kadi et al., do not necessary teach directly the limitation "adjusting the number of external neutrons depending on operating power fluctuations of the nuclear reactor". However, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to include said limitation in view of Knief drawn to the theory

and technology of commercial nuclear power, hence analogous art, who teach the reactor reactivity monitoring and feedback controlling of neutron flux density (page 152, lines 13+; Figure 5-3, page153, lines 1+). Neutron flux detectors are used for power monitoring in core (page 266, lines 44+, page 267, lines 1+). Recalculated signals from said detectors are used for feedback control of the neutron generation (Fig. 5-3, page 152, lines 34+). It is obvious for one of ordinary skill in the art to use said signal for the neutron generation control through the control of accelerator parameters because said feed back used for stabilization of neutron flux density.

Motivation for said inclusion derives from Kadi et al., who teach: "The accelerator provides a control mechanism for sub-critical systems, which is by far more convenient than control rods in critical reactors", (page 100, lines 24+).

On claim **14**, Kadi et al. teach: the operating point of the system is determined by the nominal particle energy E_p^{nom} being equal to a sum of the optimal energy E_p^{max} and an energy ΔE_p, selected so as to be greater than possible negative fluctuations of the charged particle energy in response to the negative fluctuations of the power of the reactor in the normal operating mode of the reactor (as shown in Fig. 15; operation of su-bcritical reactor with accelerator driving external neutron source with different energies of particle accelerator).

On claim **15**, Kadi et al. disclose limitation of claim 15: Method of controlling an accelerator coupled nuclear system (ACS) in accordance with claim 13, characterized in

that it comprises the following steps:

1. determining operating conditions under which the nuclear reactor is to be operated including: level of subcrildcality (r_0) (page 100, lines 6+), consumable power to be produced ((1-f) in Fig. 3; the fission power extracted; page 87, lines 8+), thermal power P_{th} or electric power $P_{el} = \eta_{el}P_{th}$ where η_{el} is the electric yield of the plant, quantity and kind of fuel (the fission power extracted; page 87, lines 8+; Fig. 16, page 110, lines 1+),

2. from the determined operating conditions, determining operating parameters of the accelerator as follows:

a - determining the optimal energy E_p^{Max} of the charged particles, which verifies the expression:

$d/dE_p, [\varphi^*(E_p)\eta_a(E_p)Y_n(E_p)/E_p] = 0$

in which E_p is the energy of the charged particles, Y_n is the neutron yield, φ^* is the neutron importance m(determined on page 1003, lines 15+), and η_a is the yield of the accelerator, (this limitation is well known, standard procedure for determination of function maximum included in devices for measurement of function or simulate functions as shown in Fig. 15, page 109, lines 1+),

b - selecting the nominal energy E_p^{nom} to be equal to or greater than the optimal energy E_p^{Max}:

$E_p^{nom} = E_p^{Max} + \Delta E_p, \Delta E_p > 0.$ (2).

(operation with this nominal energy is shown in Fig. 15; operating point with energy above 1 GeV),

c - determining a nominal intensity I_p^{nom} of the beam of charged particles necessary to

obtain a nominal power of the reactor P_{th}^{nom} depending on a nominal energy E_p^{nom}, on the neutron yield $Y_n(E_p^{nom})$, on the yield of the accelerator η_a (E_p^{nom}), on the average number v of fission neutrons, on the energy E_{fis} supplied in a fission reaction, and on the neutron importance $\varphi^*(E_p^{nom})$ for the nominal energy E_p^{nom} according to the equation:

$I_p^{nom} = r_0 v P_{th}^{nom}/[E_{fis}\ \varphi^*(E_p n^{nom})\ Y_n(E_p^{nom})]$, (3)

as well as the amount of energy produced by the reactor that is consumed by the accelerator according to the equation:

$f^{nom} = E_p^{nom} r_0 v/[E_{fis}\ \varphi^*(E_p^{nom})\ Y(E_p^{nom})\ \eta_a(E_p^{nom})\ \eta_{el}\ ]$, (4);

(as shown in Fig. 87, lines 8+).

3. setting the amount of energy produced by the reactor that can be consumed by the accelerator as a fraction f of the total energy produced by the reactor, as well as the intensity of the charged particle beam at nominal values according to the following formulas:

$I_p^{nom} = r_0 v P_{th}^{nom}/[E_{fis}\ \varphi^*\ (E_p n^{nom}) Y_n(E_p^{nom})]$, (3)

$f^{nom} = E_p^{nom} r_0 v/[E_{fis}\ \varphi^*\ (E_p^{nom}) Y(E_p^{nom})\ \eta_a\ (E_p^{nom})\ \eta_{el}\ ]$, (4);

(as shown in Fig. 3, page 92, lines 1+),

4. adjusting the number of external neutrons acting on the particle energy Ep with constant beam intensity, depending on the operating power fluctuations of the nudear reactor, according to an expression that defines the fluctuation of the energy:

$E, = f^{nom} P_{el}\ \eta_a(E_p)/I_p^{nom}$ (5);

(as shown in Fig. 15, page 108, lines 1+).

On claim **16**, Kadi et al. disclose: the charged particles are protons, and the neutron-generating nuclear reaction is a spallation reaction(proton kinetic energy in Fig. 15, page 109, lines 3+; page 92, 4.1 The Spallation process; Fig. 4; Fig. 6, 7, page 95, lines 6+).

On claim **17**, Kadi et al. disclose: the spallation target is made of lead-bismuth, and the optimal proton energy E_p^{Max} ranges from 0.5 GeV to 2.5 GeV (section 4.1 "The Spallation process", page 92-100; Fig. 6, 7).

As can be best understood in the presence of the indefiniteness under 35 U.S.C. 112, second paragraph, detailed above, regarding the claim **19**, Kadi et al., (assuming that the "level of subcriticality" is as disclosed by Kadi et al. on page 100, lines 6+) disclose:Accelerator coupled nuclear system (page 91, lines 26+, Fig. 3) comprising a nuclear reactor, having a core (Fig. 3, Fig. 16page 110, lines 1+), operating in subcritical mode (as shown in Fig. 3, page 91, lines 26+) and a neutron generator device using a beam of accelerated charged particles (in Fig. 3, page 92, lines 1+), the neutron generator consuming a predetermined amount of energy f^{nom} produced by the core in order to produce a number of external neutrons for maintaining a nuclear chain reaction in the core (f in Fig. 3), and an operating point of the system being selected at a particle energy value E_p^{nom} close to an optimal energy value E_p^{max} for which a relationship between the number of external neutrons produced and an energy of the charged particle beam used to produce the neutrons is maximum (Fig. 15, page 108, lines1+;

page 109, lines 1+), the system comprising, for a self- regulated and reliable operation, it comprises means (interpreted as an equipment for measurement and simulation of neutron generation and for processing these data) for selecting the nominal particle energy E_p^{nom} to be greater than the optimal energy value E_p^{max} (said means is procedure for determination of maximum of function existing in a standard equipment for measurement and simulation of a system operation parameters used for system design and operation as shown in Fig. 15, in Figs. 6, 7; pages 92-111), and adjusting the number of external neutrons by acting on the energy of the charged particles (E_p) generated and accelerated by the accelerator (operation points with proton kinetic energy above 1 GeV in Fig. 15; as shown in Fig. 15; operation of sub-critical reactor with accelerator driving external neutron source with different energies of particle accelerator).

Kadi et al., do not necessary teach directly the limitation "adjusting the number of external neutrons depending on operating power fluctuations of the nuclear reactor". However, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to include said limitation in view of Knief drawn to the theory and technology of commercial nuclear power, hence analogous art, who teach the reactor reactivity monitoring and feedback controlling of neutron flux density (page 152, lines 13+; Figure 5-3, page153, lines 1+). Neutron flux detectors are used for power monitoring in core (page 266, lines 44+, page 267, lines 1+). Recalculated signals from said detectors are used for feedback control of the neutron generation (Fig. 5-3, page 152, lines 34+). It is obvious for one of ordinary skill in the art to use said signal for the

neutron generation control through the control of accelerator parameters because said feed back used for stabilization of neutron flux density.

Motivation for said inclusion derives from Kadi et al., who teach: "The accelerator provides a control mechanism for sub-critical systems, which is by far more convenient than control rods in critical reactors", (page 100, lines 24+).

On claim **20**, Kadi et al. teach: means (interpreted as an equipment for measurement and simulation of neutron generation and for processing these data) for determining the operating point of the system by the nominal particle energy E_p^{nom} being equal to a sum of the optimal energy E_p^{max} and an energy ΔE_p, selected so as to be greater than possible negative fluctuations of the charged particle energy in response to the negative fluctuations of the power of the reactor in the normal operating mode of the reactor (said means is procedure for determination of maximum of function existing in a standard equipment for measurement and simulation of a system operation parameters used for system design and operation as shown in Fig. 15, in Figs. 6, 7; pages 92-111; as shown in Fig. 15; operation of sub-critical reactor with accelerator driving external neutron source with different energies of particle accelerator).

On claim **21**, Kadi et al. teach: the charged particles are protons directed in a beam at a central part of the core, and the core comprises a spallation target (as shown in Fig. 3; Fig. 16; proton kinetic energy in Fig. 15, page 109, lines 3+; page 92, 4.1 The Spallation process; Fig. 4; Fig. 6, 7, page 95, lines 6+).

On claim **23**, Kadi et al. teach: a target for producing the neutrons in response to the charged particles, the target having an optimized geometry which increases losses of the charged particles in this target (as shown in Fig. 3; Fig. 16; proton kinetic energy in Fig. 15, page 109, lines 3+; page 92, 4.1 “The Spallation process” target optimization; Fig. 4; Fig. 6, 7, page 95, lines 6+).

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Vadim Dudnikov whose telephone number is 571-270-1325. The examiner can normally be reached on 8:00 - 17:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack W. Keith can be reached, Mon-Fri 7:00am-4:00 pm, at telephone number 571-272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Patent Examiner.

VD

Vadim Dudnikov

November 21, 2007.

Primary Examiner:

(11/25/07)

Johannes Mondt

(TC 3600, AU 3663)